

(12) **United States Patent**
Stiffler et al.

(10) **Patent No.:** **US 9,601,904 B1**
(45) **Date of Patent:** **Mar. 21, 2017**

(54) **LASER DIODE DRIVER WITH VARIABLE INPUT VOLTAGE AND VARIABLE DIODE STRING VOLTAGE**

(71) Applicant: **Raytheon Company**, Waltham, MA (US)

(72) Inventors: **Robert F. Stiffler**, Lakewood, CA (US);
Joe A. Ortiz, Garden Grove, CA (US);
Philip C. Todd, Los Alamitos, CA (US); **James Lazar**, Moorpark, CA (US)

(73) Assignee: **RAYTHEON COMPANY**, Waltham, MA (US)

5,062,117	A *	10/1991	Anthon	G02B 6/4204 372/109
5,228,051	A	7/1993	Matthews	
5,287,372	A	2/1994	Ortiz	
5,363,391	A	11/1994	Matthews et al.	
5,441,803	A	8/1995	Meissner	
5,546,416	A	8/1996	Basu	
5,608,745	A	3/1997	Hall et al.	
5,625,499	A	4/1997	Chen	
5,636,239	A	6/1997	Bruesselbach et al.	
5,652,681	A	7/1997	Chen et al.	
5,736,881	A	4/1998	Ortiz	
5,846,638	A	12/1998	Meissner	
5,852,622	A	12/1998	Meissner et al.	

(Continued)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/960,515**

(22) Filed: **Dec. 7, 2015**

(51) **Int. Cl.**
H01S 5/042 (2006.01)
H01S 5/40 (2006.01)

(52) **U.S. Cl.**
CPC **H01S 5/042** (2013.01); **H01S 5/4025** (2013.01)

(58) **Field of Classification Search**
CPC H01S 5/042; H01S 5/4025
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,967,213	A	6/1976	Yariv
4,662,727	A	5/1987	Griffin
4,791,648	A	12/1988	Vojak et al.
5,048,044	A	9/1991	Ireland

OTHER PUBLICATIONS

International Search Report and Written Opinion for Application No. PCT/US2016/055248; File Date: Oct. 4, 2016, Date of Mailing: Dec. 23, 2016, pp. 1-11.

Primary Examiner — Xinning Niu

(74) *Attorney, Agent, or Firm* — Cantor Colburn LLP

(57) **ABSTRACT**

A high-power laser system includes a plurality of cascaded diode drivers, a pump source, and a laser element. The diode drivers are configured to generate a continuous driver signal. The pump source is configured to generate radiated energy in response to the continuous driver signal. The laser element is disposed downstream from the pump source and is configured to generate a laser beam in response to stimulation via the radiated energy. The high-power laser system further includes an electronic controller configured to output at least one driver signal that operates the plurality of diode drivers at a fixed frequency. The at least one driver signal operates a first cascade diode driver among the plurality of diode drivers 90 degrees out of phase with respect to a second cascade diode driver among the plurality of diode drivers.

11 Claims, 4 Drawing Sheets

